National Institute of Environmental Health Sciences

Human health risk assessment of nitrosamines and nitramines for potential application in CO2 capture

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Abstract:

Emission and accumulation of carbon dioxide (CO2) in the atmosphere exert an environmental and climate change challenge. An attempt to deal with this challenge is made at Mongstad by application of amines for CO2 capture and storage (CO2 capture Mongstad (CCM) project). As part of the CO2 capture process, nitrosamines and nitramines may be emitted. Toxicological testing of nitrosamines and nitramines indicate a genotoxic potential of these substances. Here we present a risk characterization and assessment for five nitrosamines (N-Nitrosodi-methylamine (NDMA) N-Nitrosodi-ethylamine (NDEA), N-Nitroso-morpholine (NNM), N-Nitroso-piperidine (NPIP), and Dinitroso-piperazine (DNP)) and two nitramines (N-Methyl-nitramine (NTMA), Dimethyl-nitramine (NDTMA)), which are potentially emitted from the CO2 capture plant (CCP). Human health risk assessment of genotoxic non-threshold substances is a heavily debated topic, and no consensus methodology exists internationally. Extrapolation modeling from high-dose animal exposures to low-dose human exposures can be crucial for the final risk calculation. In the work presented here, different extrapolation models are discussed, and suggestions on applications are given. Then, preferred methods for calculating derived minimal effect level (DMEL) are presented with the selected nitrosamines and nitramines.

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Resource Description

Exposure : ☑

weather or climate related pathway by which climate change affects health

Air Pollution, Food/Water Quality, Unspecified Exposure

Air Pollution: Other Air Pollution

Air Pollution (other): N-Nitrosodi-methylamine (NDMA); N-Nitrosodi-ethylamine (NDEA); N-Nitroso-morpholine (NNM); N-Nitroso-piperidine (NPIP); Dinitroso-piperazine (DNP); N-Methyl-nitramine (NTMA); Dimethyl-nitramine (NDTMA)

Food/Water Quality: Chemical

Geographic Feature: ☑

resource focuses on specific type of geography

None or Unspecified

Geographic Location: ☑

resource focuses on specific location

Global or Unspecified

Health Co-Benefit/Co–Harm (Adaption/Mitigation): ☑

specification of beneficial or harmful impacts to health resulting from efforts to reduce or cope with greenhouse gases

A focus of content

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Cancer, Other Health Impact

Other Health Impact: Genotoxicity

Mitigation/Adaptation: ☑

mitigation or adaptation strategy is a focus of resource

Mitigation

Resource Type: ☑

format or standard characteristic of resource

Research Article, Review

Timescale: ☑

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment: ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content